

# SEQUENCE LISTING

<110> Chiron SpA  
 GRANDI, Guido  
 RAPPUOLI, Rino  
 GIULIANI, Marzia Monica  
 PIZZA, Mariagrazia

<120> ENHANCEMENT OF BACTERICIDAL ACTIVITY OF NEISSERIA ANTIGENS WITH  
 OLIGONUCLEOTIDES CONTAINING CG MOTIFS

<130> 22300-21022.00

<140> US 09/914,454  
 <141> 2002-01-14

<150> PCT/IB00/00176  
 <151> 2000-02-09

<150> US 60/121,792  
 <151> 1999-02-26

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 gaccggccgg tcggcatccc cgaccccgcc ggaacgacgg tcggcgggcg cggggccgtc 180  
 tataccgttg taccgcacct gtccctgccc cactggggcg cgaggattt cgccaaaagc 240  
 ctgcaatcct tccgcctcgg ctgcgccaat ttgaaaaacc gccaaaggctg gcaggatgtg 300  
 tgcgcccgaag cctttcaaac ccccgctccat tcctttcagg caaaacagtt ttttgaacgc 360  
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 cataccgccg acctctcccg attccccatc accgcgcgca caacagcaat caaaggcagg 660  
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 gacggcaaag ccccgatact cggttacgcc gaagaccctg tcgaactttt ttttatgcac 780  
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 Asp Thr Ser Val Ile Asn Gly Pro Asp Arg Pro Val Gly Ile Pro Asp  
 35 40 45  
 Pro Ala Gly Thr Thr Val Gly Gly Gly Gly Ala Val Tyr Thr Val Val  
 50 55 60  
 Pro His Leu Ser Leu Pro His Trp Ala Ala Gln Asp Phe Ala Lys Ser  
 65 70 75 80  
 Leu Gln Ser Phe Arg Leu Gly Cys Ala Asn Leu Lys Asn Arg Gln Gly  
 85 90 95  
 Trp Gln Asp Val Cys Ala Gln Ala Phe Gln Thr Pro Val His Ser Phe  
 100 105 110

Gln Ala Lys Gln Phe Phe Glu Arg Tyr Phe Thr Pro Trp Gln Val Ala  
 115 120 125  
 Gly Asn Gly Ser Leu Ala Gly Thr Val Thr Gly Tyr Tyr Glu Pro Val  
 130 135 140  
 Leu Lys Gly Asp Asp Arg Arg Thr Ala Gln Ala Arg Phe Pro Ile Tyr  
 145 150 155 160  
 Gly Ile Pro Asp Asp Phe Ile Ser Val Pro Leu Pro Ala Gly Leu Arg  
 165 170 175  
 Ser Gly Lys Ala Leu Val Arg Ile Arg Gln Thr Gly Lys Asn Ser Gly  
 180 185 190  
 Thr Ile Asp Asn Thr Gly Gly Thr His Thr Ala Asp Leu Ser Arg Phe  
 195 200 205  
 Pro Ile Thr Ala Arg Thr Thr Ala Ile Lys Gly Arg Phe Glu Gly Ser  
 210 215 220  
 Arg Phe Leu Pro Tyr His Thr Arg Asn Gln Ile Asn Gly Gly Ala Leu  
 225 230 235 240  
 Asp Gly Lys Ala Pro Ile Leu Gly Tyr Ala Glu Asp Pro Val Glu Leu  
 245 250 255  
 Phe Phe Met His Ile Gln Gly Ser Gly Arg Leu Lys Thr Pro Ser Gly  
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 Lys Tyr Ile Arg Ile Gly Tyr Ala Asp Lys Asn Glu His Pro Tyr Val  
 275 280 285  
 Ser Ile Gly Arg Tyr Met Ala Asp Lys Gly Tyr Leu Lys Leu Gly Gln  
 290 295 300  
 Thr Ser Met Gln Gly Ile Lys Ser Tyr Met Arg Gln Asn Pro Gln Arg  
 305 310 315 320  
 Leu Ala Glu Val Leu Gly Gln Asn Pro Ser Tyr Ile Phe Phe Arg Glu  
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 Leu Ala Gly Ser Ser Asn Asp Gly Pro Val Gly Ala Leu Gly Thr Pro  
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 Leu Met Gly Glu Tyr Ala Gly Ala Val Asp Arg His Tyr Ile Thr Leu  
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 Gly Ala Pro Leu Phe Val Ala Thr Ala His Pro Val Thr Arg Lys Ala  
 370 375 380  
 Leu Asn Arg Leu Ile Met Ala Gln Asp Thr Gly Ser Ala Ile Asp Gly  
 385 390 395 400  
 Ala Val Arg Val Asp Tyr Phe Trp Gly Tyr Gly Asp Glu Ala Gly Glu  
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 Val Gly Asp Thr Tyr Asn Asp Thr His Gly Ser Ala Ile Ile Lys Ser  
 50 55 60  
 Leu Tyr Ala Thr Gly Phe Phe Asp Asp Val Arg Val Glu Thr Ala Asp  
 65 70 75 80  
 Gly Gln Leu Leu Leu Thr Val Ile Glu Arg Pro Thr Ile Gly Ser Leu  
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 Asn Ile Thr Gly Ala Lys Met Leu Gln Asn Asp Ala Ile Lys Lys Asn  
 100 105 110  
 Leu Glu Ser Phe Gly Leu Ala Gln Ser Gln Tyr Phe Asn Gln Ala Thr  
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 Arg Ser Asn Gln Phe Asn Glu Gln Lys Phe Ala Gln Asp Met Glu Lys  
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 Val Thr Asp Phe Tyr Gln Asn Asn Gly Tyr Phe Asp Phe Arg Ile Leu  
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Asp Thr Asp Ile Gln Thr Asn Glu Asp Lys Thr Lys Gln Thr Ile Lys  
 245 250 255  
 Ile Thr Val His Glu Gly Gly Arg Phe Arg Trp Gly Lys Val Ser Ile  
 260 265 270  
 Glu Gly Asp Thr Asn Glu Val Pro Lys Ala Glu Leu Glu Lys Leu Leu  
 275 280 285  
 Thr Met Lys Pro Gly Lys Trp Tyr Glu Arg Gln Gln Met Thr Ala Val  
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 Leu Gly Glu Ile Gln Asn Arg Met Gly Ser Ala Gly Tyr Ala Tyr Ser  
 305 310 315 320  
 Glu Ile Ser Val Gln Pro Leu Pro Asn Ala Glu Thr Lys Thr Val Asp  
 325 330 335  
 Phe Val Leu His Ile Glu Pro Gly Arg Lys Ile Tyr Val Asn Glu Ile  
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 His Ile Thr Gly Asn Asn Lys Thr Arg Asp Glu Val Val Arg Arg Glu  
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 Leu Arg Gln Met Glu Ser Ala Pro Tyr Asp Thr Ser Lys Leu Gln Arg  
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 Ser Lys Glu Arg Val Glu Leu Leu Gly Tyr Phe Asp Asn Val Gln Phe  
 385 390 395 400  
 Asp Ala Val Pro Leu Ala Gly Thr Pro Asp Lys Val Asp Leu Asn Met  
 405 410 415  
 Ser Leu Thr Glu Arg Ser Thr Gly Ser Leu Asp Leu Ser Ala Gly Trp  
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 Val Gln Asp Thr Gly Leu Val Met Ser Ala Gly Val Ser Gln Asp Asn  
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 Thr Thr Leu Asn Gly Ser Leu Ser Phe Thr Asp Pro Tyr Phe Thr Ala  
 465 470 475 480  
 Asp Gly Val Ser Leu Gly Tyr Asp Val Tyr Gly Lys Ala Phe Asp Pro  
 485 490 495  
 Arg Lys Ala Ser Thr Ser Ile Lys Gln Tyr Lys Thr Thr Thr Ala Gly  
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 Ala Gly Ile Arg Met Ser Val Pro Val Thr Glu Tyr Asp Arg Val Asn  
 515 520 525  
 Phe Gly Leu Val Ala Glu His Leu Thr Val Asn Thr Tyr Asn Lys Ala  
 530 535 540

Pro Lys His Tyr Ala Asp Phe Ile Lys Lys Tyr Gly Lys Thr Asp Gly  
 545 550 555 560  
 Thr Asp Gly Ser Phe Lys Gly Trp Leu Tyr Lys Gly Thr Val Gly Trp  
 565 570 575  
 Gly Arg Asn Lys Thr Asp Ser Ala Leu Trp Pro Thr Arg Gly Tyr Leu  
 580 585 590  
 Thr Gly Val Asn Ala Glu Ile Ala Leu Pro Gly Ser Lys Leu Gln Tyr  
 595 600 605  
 Tyr Ser Ala Thr His Asn Gln Thr Trp Phe Phe Pro Leu Ser Lys Thr  
 610 615 620  
 Phe Thr Leu Met Leu Gly Gly Glu Val Gly Ile Ala Gly Gly Tyr Gly  
 625 630 635 640  
 Arg Thr Lys Glu Ile Pro Phe Phe Glu Asn Phe Tyr Gly Gly Gly Leu  
 645 650 655  
 Gly Ser Val Arg Gly Tyr Glu Ser Gly Thr Leu Gly Pro Lys Val Tyr  
 660 665 670  
 Asp Glu Tyr Gly Glu Lys Ile Ser Tyr Gly Gly Asn Lys Lys Ala Asn  
 675 680 685  
 Val Ser Ala Glu Leu Leu Phe Pro Met Pro Gly Ala Lys Asp Ala Arg  
 690 695 700  
 Thr Val Arg Leu Ser Leu Phe Ala Asp Ala Gly Ser Val Trp Asp Gly  
 705 710 715 720  
 Lys Thr Tyr Asp Asp Asn Ser Ser Ser Ala Thr Gly Gly Arg Val Gln  
 725 730 735  
 Asn Ile Tyr Gly Ala Gly Asn Thr His Lys Ser Thr Phe Thr Asn Glu  
 740 745 750  
 Leu Arg Tyr Ser Ala Gly Gly Ala Val Thr Trp Leu Ser Pro Leu Gly  
 755 760 765  
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 35 40 45  
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 Leu Tyr Ala Thr Gly Phe Phe Asp Asp Val Arg Val Glu Thr Ala Asp  
 65 70 75 80  
 Gly Gln Leu Leu Leu Thr Val Ile Glu Arg Pro Thr Ile Gly Ser Leu  
 85 90 95  
 Asn Ile Thr Gly Ala Lys Met Leu Gln Asn Asp Ala Ile Lys Lys Asn  
 100 105 110  
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 115 120 125  
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 130 135 140  
 Lys Leu Asn Ile Gln Ile Thr Pro Lys Val Thr Lys Leu Ala Arg Asn  
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 Arg Val Asp Ile Asp Ile Thr Ile Asp Glu Gly Lys Ser Ala Lys Ile  
 165 170 175  
 Thr Asp Ile Glu Phe Glu Gly Asn Gln Val Tyr Ser Asp Arg Lys Leu  
 180 185 190  
 Met Arg Gln Met Ser Leu Thr Glu Gly Gly Ile Trp Thr Trp Leu Thr  
 195 200 205  
 Arg Ser Asp Arg Phe Asp Arg Gln Lys Phe Ala Gln Asp Met Glu Lys  
 210 215 220  
 Val Thr Asp Phe Tyr Gln Asn Asn Gly Tyr Phe Asp Phe Arg Ile Leu  
 225 230 235 240  
 Asp Thr Asp Ile Gln Thr Asn Glu Asp Lys Thr Arg Gln Thr Ile Lys  
 245 250 255  
 Ile Thr Val His Glu Gly Gly Arg Phe Arg Trp Gly Lys Val Ser Ile  
 260 265 270  
 Glu Gly Asp Thr Asn Glu Val Pro Lys Ala Glu Leu Glu Lys Leu Leu  
 275 280 285  
 Thr Met Lys Pro Gly Lys Trp Tyr Glu Arg Gln Gln Met Thr Ala Val  
 290 295 300  
 Leu Gly Glu Ile Gln Asn Arg Met Gly Ser Ala Gly Tyr Ala Tyr Ser  
 305 310 315 320

Glu Ile Ser Val Gln Pro Leu Pro Asn Ala Gly Thr Lys Thr Val Asp  
 325 330 335  
 Phe Val Leu His Ile Glu Pro Gly Arg Lys Ile Tyr Val Asn Glu Ile  
 340 345 350  
 His Ile Thr Gly Asn Asn Lys Thr Arg Asp Glu Val Val Arg Arg Glu  
 355 360 365  
 Leu Arg Gln Met Glu Ser Ala Pro Tyr Asp Thr Ser Lys Leu Gln Arg  
 370 375 380  
 Ser Lys Glu Arg Val Glu Leu Leu Gly Tyr Phe Asp Asn Val Gln Phe  
 385 390 395 400  
 Asp Ala Val Pro Leu Ala Gly Thr Pro Asp Lys Val Asp Leu Asn Met  
 405 410 415  
 Ser Leu Thr Glu Arg Ser Thr Gly Ser Leu Asp Leu Ser Ala Gly Trp  
 420 425 430  
 Val Gln Asp Thr Gly Leu Val Met Ser Ala Gly Val Ser Gln Asp Asn  
 435 440 445  
 Leu Phe Gly Thr Gly Lys Ser Ala Ala Leu Arg Ala Ser Arg Ser Lys  
 450 455 460  
 Thr Thr Leu Asn Gly Ser Leu Ser Phe Thr Asp Pro Tyr Phe Thr Ala  
 465 470 475 480  
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 485 490 495  
 Arg Lys Ala Ser Thr Ser Val Lys Gln Tyr Lys Thr Thr Thr Ala Gly  
 500 505 510  
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 515 520 525  
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 Pro Lys Arg Tyr Ala Asp Phe Ile Arg Lys Tyr Gly Lys Thr Asp Gly  
 545 550 555 560  
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 580 585 590  
 Thr Gly Val Asn Ala Glu Ile Ala Leu Pro Gly Ser Lys Leu Gln Tyr  
 595 600 605  
 Tyr Ser Ala Thr His Asn Gln Thr Trp Phe Phe Pro Leu Ser Lys Thr  
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Phe Thr Leu Met Leu Gly Gly Glu Val Gly Ile Ala Gly Gly Tyr Gly  
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 Arg Thr Lys Glu Ile Pro Phe Phe Glu Asn Phe Tyr Gly Gly Gly Leu  
 645 650 655  
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 660 665 670  
 Asp Glu Tyr Gly Glu Lys Ile Ser Tyr Gly Gly Asn Lys Lys Ala Asn  
 675 680 685  
 Val Ser Ala Glu Leu Leu Phe Pro Met Pro Gly Ala Lys Asp Ala Arg  
 690 695 700  
 Thr Val Arg Leu Ser Leu Phe Ala Asp Ala Gly Ser Val Trp Asp Gly  
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 Arg Thr Tyr Thr Ala Ala Glu Asn Gly Asn Asn Lys Ser Val Tyr Ser  
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 Glu Asn Ala His Lys Ser Thr Phe Thr Asn Glu Leu Arg Tyr Ser Ala  
 740 745 750  
 Gly Gly Ala Val Thr Trp Leu Ser Pro Leu Gly Pro Met Lys Phe Ser  
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 Gln Phe Gln Leu Gly Thr Thr Phe  
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 Leu Gln Arg Thr Glu Pro Ser Thr Val Phe Asn Tyr Leu Pro Val Lys  
 35 40 45  
 Val Gly Asp Thr Tyr Asn Asp Thr His Gly Ser Ala Ile Ile Lys Ser  
 50 55 60  
 Leu Tyr Ala Thr Gly Phe Phe Asp Asp Val Arg Val Glu Thr Ala Asp  
 65 70 75 80  
 Gly Gln Leu Leu Leu Thr Val Ile Glu Arg Pro Thr Ile Gly Ser Leu  
 85 90 95

Asn	Ile	Thr	Gly	Ala	Lys	Met	Leu	Gln	Asn	Asp	Ala	Ile	Lys	Lys	Asn		
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Leu	Glu	Ser	Phe	Gly	Leu	Ala	Gln	Ser	Gln	Tyr	Phe	Asn	Gln	Ala	Thr		
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Leu	Asn	Gln	Ala	Val	Ala	Gly	Leu	Lys	Glu	Glu	Tyr	Leu	Gly	Arg	Gly		
	130					135					140						
Lys	Leu	Asn	Ile	Gln	Ile	Thr	Pro	Lys	Val	Thr	Lys	Leu	Ala	Arg	Asn		
145					150					155					160		
Arg	Val	Asp	Ile	Asp	Ile	Thr	Ile	Asp	Glu	Gly	Lys	Ser	Ala	Lys	Ile		
				165					170						175		
Thr	Asp	Ile	Glu	Phe	Glu	Gly	Asn	Gln	Val	Tyr	Ser	Asp	Arg	Lys	Leu		
			180					185						190			
Met	Arg	Gln	Met	Ser	Leu	Thr	Glu	Gly	Gly	Ile	Trp	Thr	Trp	Leu	Thr		
		195					200					205					
Arg	Ser	Asn	Gln	Phe	Asn	Glu	Gln	Lys	Phe	Ala	Gln	Asp	Met	Glu	Lys		
		210				215					220						
Val	Thr	Asp	Phe	Tyr	Gln	Asn	Asn	Gly	Tyr	Phe	Asp	Phe	Arg	Ile	Leu		
225					230				235						240		
Asp	Thr	Asp	Ile	Gln	Thr	Asn	Glu	Asp	Lys	Thr	Lys	Gln	Thr	Ile	Lys		
				245					250					255			
Ile	Thr	Val	His	Glu	Gly	Gly	Arg	Phe	Arg	Trp	Gly	Lys	Val	Ser	Ile		
			260					265					270				
Glu	Gly	Asp	Thr	Asn	Glu	Val	Pro	Lys	Ala	Glu	Leu	Glu	Lys	Leu	Leu		
		275					280					285					
Thr	Met	Lys	Pro	Gly	Lys	Trp	Tyr	Glu	Arg	Gln	Gln	Met	Thr	Ala	Val		
	290					295					300						
Leu	Gly	Glu	Ile	Gln	Asn	Arg	Met	Gly	Ser	Ala	Gly	Tyr	Ala	Tyr	Ser		
305					310					315					320		
Glu	Ile	Ser	Val	Gln	Pro	Leu	Pro	Asn	Ala	Glu	Thr	Lys	Thr	Val	Asp		
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Phe	Val	Leu	His	Ile	Glu	Pro	Gly	Arg	Lys	Ile	Tyr	Val	Asn	Glu	Ile		
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His	Ile	Thr	Gly	Asn	Asn	Lys	Thr	Arg	Asp	Glu	Val	Val	Arg	Arg	Glu		
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Leu	Arg	Gln	Met	Glu	Ser	Ala	Pro	Tyr	Asp	Thr	Ser	Lys	Leu	Gln	Arg		
	370					375					380						
Ser	Lys	Glu	Arg	Val	Glu	Leu	Leu	Gly	Tyr	Phe	Asp	Asn	Val	Gln	Phe		
385					390					395					400		

Asp Ala Val Pro Leu Ala Gly Thr Pro Asp Lys Val Asp Leu Asn Met  
 405 410 415  
 Ser Leu Thr Glu Arg Ser Thr Gly Ser Leu Asp Leu Ser Ala Gly Trp  
 420 425 430  
 Val Gln Asp Thr Gly Leu Val Met Ser Ala Gly Val Ser Gln Asp Asn  
 435 440 445  
 Leu Phe Gly Thr Gly Lys Ser Ala Ala Leu Arg Ala Ser Arg Ser Lys  
 450 455 460  
 Thr Thr Leu Asn Gly Ser Leu Ser Phe Thr Asp Pro Tyr Phe Thr Ala  
 465 470 475 480  
 Asp Gly Val Ser Leu Gly Tyr Asp Val Tyr Gly Lys Ala Phe Asp Pro  
 485 490 495  
 Arg Lys Ala Ser Thr Ser Ile Lys Gln Tyr Lys Thr Thr Thr Ala Gly  
 500 505 510  
 Ala Gly Ile Arg Met Ser Val Pro Val Thr Glu Tyr Asp Arg Val Asn  
 515 520 525  
 Phe Gly Leu Val Ala Glu His Leu Thr Val Asn Thr Tyr Asn Lys Ala  
 530 535 540  
 Pro Lys His Tyr Ala Asp Phe Ile Lys Lys Tyr Gly Lys Thr Asp Gly  
 545 550 555 560  
 Thr Asp Gly Ser Phe Lys Gly Trp Leu Tyr Lys Gly Thr Val Gly Trp  
 565 570 575  
 Gly Arg Asn Lys Thr Asp Ser Ala Leu Trp Pro Thr Arg Gly Tyr Leu  
 580 585 590  
 Thr Gly Val Asn Ala Glu Ile Ala Leu Pro Gly Ser Lys Leu Gln Tyr  
 595 600 605  
 Tyr Ser Ala Thr His Asn Gln Thr Trp Phe Phe Pro Leu Ser Lys Thr  
 610 615 620  
 Phe Thr Leu Met Leu Gly Gly Glu Val Gly Ile Ala Gly Gly Tyr Gly  
 625 630 635 640  
 Arg Thr Lys Glu Ile Pro Phe Phe Glu Asn Phe Tyr Gly Gly Gly Leu  
 645 650 655  
 Gly Ser Val Arg Gly Tyr Glu Ser Gly Thr Leu Gly Pro Lys Val Tyr  
 660 665 670  
 Asp Glu Tyr Gly Glu Lys Ile Ser Tyr Gly Gly Asn Lys Lys Ala Asn  
 675 680 685  
 Val Ser Ala Glu Leu Leu Phe Pro Met Pro Gly Ala Lys Asp Ala Arg  
 690 695 700

Thr	Val	Arg	Leu	Ser	Leu	Phe	Ala	Asp	Ala	Gly	Ser	Val	Trp	Asp	Gly	705	710	715	720
Lys	Thr	Tyr	Asp	Asp	Asn	Ser	Ser	Ser	Ala	Thr	Gly	Gly	Arg	Val	Gln	725	730	735	
Asn	Ile	Tyr	Gly	Ala	Gly	Asn	Thr	His	Lys	Ser	Thr	Phe	Thr	Asn	Glu	740	745	750	
Leu	Arg	Tyr	Ser	Ala	Gly	Gly	Ala	Val	Thr	Trp	Leu	Ser	Pro	Leu	Gly	755	760	765	
Pro	Met	Lys	Phe	Ser	Tyr	Ala	Tyr	Pro	Leu	Lys	Lys	Lys	Pro	Glu	Asp	770	775	780	
Glu	Ile	Gln	Arg	Phe	Gln	Phe	Gln	Leu	Gly	Thr	Thr	Phe				785	790	795	